General Theory Of Elastic Wave Scattering Inside Mines

Seismic Wave Propagation and Scattering in the Heterogenous Earth *Wave Scattering in Complex Media: From Theory to Applications* **Scattering of Electromagnetic Waves** *Wave Scattering in Complex Media: From Theory to Applications* **Introduction to Wave Scattering, Localization and Mesoscopic Phenomena Wave Propagation and Scattering in Random Media Rays, Waves, and Scattering Wave Propagation and Scattering in Random Media Seismic Wave Propagation and Scattering in the Heterogeneous Earth : Second Edition Wave Scattering from Rough Surfaces** Wave Scattering by Time-Dependent Perturbations **Wave Propagation and Scattering in Random Media** Electromagnetic Wave Scattering from Random Rough Surfaces **Interface Effects in Elastic Wave Scattering** *Scattering, Two-Volume Set Seismic Wave Propagation and Scattering in the Heterogeneous Earth : Second Edition* Electromagnetic Wave Scattering by Aerial and Ground Radar Objects **Electromagnetic Wave Propagation, Radiation, and Scattering Wave Scattering by Small Bodies of Arbitrary Shapes Electromagnetic Wave Propagation, Radiation, and Scattering Water Wave Scattering Wave Scattering from Statistically Rough Surfaces** Rays, Waves, and Scattering **Forward Brillouin Scattering in Standard Optical Fibers** *Plane-wave Scattering-matrix Theory of Antennas and Antenna-antenna Interactions* **Scattering Theory of Waves and Particles Wave Scattering Theory** *Wave Scattering from Rough Surfaces Theory of Wave Scattering From Random Rough Surfaces,* Electromagnetic Wave Scattering on Nonspherical Particles **Scattering Theory of Waves and Particles Radar Propagation and Scattering in a Complex Maritime Environment** Scattering of Electromagnetic Waves Electromagnetic Wave Scattering on Nonspherical Particles **Scattering of Electromagnetic Waves Lectures in Scattering Theory** *Radio Wave Scattering in the Interstellar Medium* **Wave Scattering in Complex Media: From Theory to Applications Scattering of Electromagnetic Waves by Obstacles Method of Moments for 2D Scattering Problems**

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Wave Propagation and Scattering in Random Media Nov 24 2021 Wave Propagation and Scattering in Random Media, Volume 2, presents the fundamental formulations of wave propagation and scattering in random media in a unified and systematic manner. The topics covered in this book may be grouped into three categories: waves in random scatterers, waves in random continua, and rough surface scattering. Random scatterers are random distributions of many particles. Examples are rain, fog, smog, hail, ocean particles, red blood cells, polymers, and other particles in a state of Brownian motion. Random continua are the media whose characteristics vary randomly and continuously in time and space. Examples are clear air turbulence, jet engine exhaust, tropospheric and ionospheric turbulence, ocean turbulence, and biological media such as tissue and muscle. Rough surface examples are the ocean surface, planetary surfaces, interfaces between different biological media, and the surface roughness of an optical fiber. This book is intended for engineers and scientists interested in optical, acoustic, and microwave propagation and scattering in atmospheres, oceans, and biological media, and particularly for those involved in communication through such media and remote sensing of the characteristics of these media.

Wave Scattering by Time-Dependent Perturbations Dec 26 2021 This book offers the first comprehensive introduction to wave scattering in nonstationary materials. G. F. Roach's aim is to provide an accessible, self-contained resource for newcomers to this important field of research that has applications across a broad range of areas, including radar, sonar, diagnostics in engineering and manufacturing, geophysical prospecting, and ultrasonic medicine such as sonograms. New methods in recent years have been developed to assess the structure and properties of materials and surfaces. When light, sound, or some other wave energy is directed at the material in question, "imperfections" in the resulting echo can reveal a tremendous amount of valuable diagnostic information. The mathematics behind such analysis is sophisticated and complex. However, while problems involving stationary materials are quite well understood, there is still much to learn about those in which the material is moving or changes over time. These so-called non-autonomous problems are the subject of this fascinating book. Roach develops practical strategies, techniques, and solutions for mathematicians and applied scientists working in or seeking entry into the field of modern scattering theory and its applications. Wave Scattering by Time-Dependent Perturbations is destined to become a classic in this rapidly evolving area of inquiry.

Scattering Theory of Waves and Particles Sep 10 2020 Much progress has been made in scattering theory since the publication of the first edition of this book fifteen years ago, and it is time to update it. Needless to say, it was impossible to incorporate all areas of new develop ment. Since among the newer books on scattering theory there are three excellent volumes that treat the subject from a much more abstract mathe matical point of view (Lax and Phillips on electromagnetic scattering, Amrein, Jauch and Sinha, and Reed and Simon on quantum scattering), I have refrained from adding material concerning the abundant new mathe matical results on time-dependent formulations of scattering theory. The only exception is Dollard's beautiful "scattering into cones" method that connects the physically intuitive and mathematically clean wave-packet description to experimentally accessible scattering rates in a much more satisfactory manner than the older procedure. Areas that have been substantially augmented are the analysis of the three-dimensional Schrodinger equation for non central potentials (in Chapter 10), the general approach to multiparticle reaction theory (in Chapter 16), the specific treatment of three-particle scattering (in Chapter 17), and inverse scattering (in Chapter 20). The additions to Chapter 16 include an introduction to the two-Hilbert space approach, as well as a derivation of general scattering-rate formulas. Chapter 17 now contains a survey of various approaches to the solution of three-particle problems, as well as a discussion of the Efimov effect.

Wave Propagation and Scattering in Random Media May 31 2022 Electrical Engineering Wave Propagation and Scattering in Random Media A volume in the IEEE/OUP Series on Electromagnetic Wave Theory Donald G. Dudley, Series Editor This IEEE Classic Reissue presents a unified introduction to the fundamental theories and applications of wave propagation and scattering in random media. Now for the first time, the two volumes of Wave Propagation and Scattering in Random Media previously published by Academic Press in 1978 are combined into one comprehensive volume. This book presents a clear picture of how waves interact with the atmosphere, terrain, ocean, turbulence, aerosols, rain, snow, biological tissues, composite material, and other media. The theories presented will enable you to solve a variety of problems relating to clutter, interference, imaging, object detection, and communication theory for various media. This book is expressly designed for engineers and scientists who have an interest in optical, microwave, or acoustic wave propagation and scattering. Topics covered include: Wave characteristics in aerosols and hydrometeors Optical and acoustic scattering in sea water Scattering from biological materials Pulse scattering and beam wave propagation in such media Optical diffusion in tissues and blood Transport and radiative transfer theory Kubelka—Munk flux theory and plane-parallel problem Multiple scattering theory Wave fluctuations in turbulence Strong fluctuation theory Rough surface scattering Remote sensing and inversion techniques Imaging through various media About the IEEE/OUP Series on Electromagnetic Wave Theory Formerly the IEEE Press Series on Electromagnetic Waves, this joint series between IEEE Press and Oxford University Press offers outstanding coverage of the field with new titles as well as reprintings and revisions of recognized classics that maintain long-term archival significance in electromagnetic waves and applications. Designed specifically for graduate students, practicing engineers, and researchers, this series provides affordable volumes that explore electromagnetic waves and applications beyond the undergraduate level. See page il of the front matter for a listing of books in this series.

Electromagnetic Wave Scattering by Aerial and Ground Radar Objects Jun 19 2021 Electromagnetic Wave Scattering by Aerial and Ground Radar Objects presents the theory, original calculation methods, and computational results of the scattering characteristics of different aerial and ground radar objects. This must-have book provides essential background for computing electromagnetic wave scattering in the presence of different kinds of irregularities, as well as Summarizes fundamental electromagnetic statements such as the Lorentz reciprocity theorem and the image principle Contains integral field representations enabling the study of scattering from various layered structures Describes scattering computation techniques for objects with surface fractures and radar-absorbent coatings Covers elimination of "terminator discontinuities" appearing in the method of physical optics in general bistatic cases Includes radar cross-section (RCS) statistics and high-range resolution profiles of assorted aircrafts, cruise missiles, and tanks Complete with radar backscattering diagrams, echo signal amplitude probability distributions, and other valuable reference material, Electromagnetic Wave Scattering by Aerial and Ground Radar Objects is ideal for scientists, engineers, and researchers of electromagnetic wave scattering, computational electrodynamics, and radar detection and recognition algorithms.

Seismic Wave Propagation and Scattering in the Heterogeneous Earth : Second Edition Feb 25 2022 Seismic waves - generated both by natural earthquakes and by man-made sources - have produced an enormous amount of information about the Earth's interior. In classical seismology, the Earth is modeled as a sequence of uniform horizontal layers (or spherical shells) having different elastic properties and one determines these properties from travel times and dispersion of seismic waves. The Earth, however, is not made of horizontally uniform layers, and classic seismic methods can take large-scale inhomogeneities into account. Smaller-scale irregularities, on the other hand, require other methods. Observations of continuous wave trains that follow classic direct S waves, known as coda waves, have shown that there are heterogeneities of random size scattered randomly throughout the layers of the classic seismic model. This book focuses on recent developments in the area of seismic wave propagation and scattering through the randomly heterogeneous structure of the Earth, with emphasis on the lithosphere. The presentation combines information from many sources to present a coherent

introduction to the theory of scattering in acoustic and elastic materials and includes analyses of observations using the theoretical methods developed. The second edition especially includes new observational facts such as the spatial variation of medium inhomogeneities and the temporal change in scattering characteristics and recent theoretical developments in the envelope synthesis in random media for the last ten years. Mathematics is thoroughly rewritten for improving the readability. Written for advanced undergraduates or beginning graduate students of geophysics or planetary sciences, this book should also be of interest to civil engineers, seismologists, acoustical engineers, and others interested in wave propagation through inhomogeneous elastic media.

Wave Scattering in Complex Media: From Theory to Applications Aug 29 2019 A collection of lectures on a variety of modern subjects in wave scattering, including fundamental issues in mesoscopic physics and radiative transfer, recent hot topics such as random lasers, liquid crystals, lefthanded materials and time-reversal, as well as modern applications in imaging and communication. There is a strong emphasis on the interdisciplinary aspects of wave propagation, including light and microwaves, acoustic and elastic waves, propagating in a variety of "complex" materials (liquid crystals, media with gain, natural media, magneto-optical media, photonic and phononic materials, etc.). It addresses many different items in contemporary research: mesoscopic fluctuations, localization, radiative transfer, symmetry aspects, and time-reversal. It also discusses new (potential) applications in telecommunication, soft matter and imaging.

Scattering of Electromagnetic Waves Feb 02 2020 A timely and authoritative guide to the state of the art of wavescattering Scattering of Electromagnetic Waves offers in three volumes acomplete and up-to-date treatment of wave scattering by randomdiscrete scatterers and rough surfaces. Written by leadingscientists who have made important contributions to wave scatteringover three decades, this new work explains the principles, methods,and applications of this rapidly expanding, interdisciplinaryfield. It covers both introductory and advanced material andprovides students and researchers in remote sensing as well asimaging, optics, and electromagnetic theory with a one-stopreference to a wealth of current research results. Plus, Scatteringof Electromagnetic Waves contains detailed discussions of bothanalytical and numerical methods, including cutting-edge techniquesfor the recovery of earth/land parametric information. The three volumes are entitled respectively Theories andApplications, Numerical Simulation, and Advanced Topics. In thethird volume, Advanced Topics, Leung Tsang (University ofWashington) and Jin Au Kong (MIT), cover: * Two-dimensional random rough surface scattering * Kirchhoff and related methods for rough surface scattering * Analytic theory of volume scattering based on cascading oflayers * Analytic wave theory for medium with permittivityfluctuations * Multiple scattering theory for discrete scatterers * Quasicrystalline approximation in dense media scattering * Dense media scattering * Backscattering enhancement

Introduction to Wave Scattering, Localization and Mesoscopic Phenomena Jul 01 2022 Waves represent an important topic of study in physics, mathematics, and engineering. This volume is a resource book for those interested in understanding the physics underlying nanotechnology and mesoscopic phenomena. It aims to bridge the gap between the textbooks and research frontiers in wave related topics.

Scattering of Electromagnetic Waves by Obstacles Jul 29 2019 Electromagnetic (EM) wave scattering is of fundamental importance to antenna and radar design engineering, and the increasing interest in metamaterials has created a need for new approaches to solving scattering problems for characterizing engineered media. This book lays the theoretical foundation for new computer programs in computational electromagnetics (CEM) and meets the need of today s researchers. This book represents over 30 years of the author s experience teaching this topic, with extensive lectures notes expanded to include advanced concepts and mathematical solutions to cover moderneffects on metamaterials and related advanced complexities.Problems and solutions at the end of each chapter help to reinforce concepts and highlight applications. This is an ideal text for advanced graduate students and researchers in EM and applied physics."

Scattering of Electromagnetic Waves Sep 03 2022 A timely and authoritative guide to the state of the art of wavescattering Scattering of Electromagnetic Waves offers in three volumes acomplete and up-to-date treatment of wave scattering by randomdiscrete scatterers and rough surfaces. Written by leadingscientists who have made important contributions to wave scatteringover three decades, this new work explains the principles, methods,and applications of this rapidly expanding, interdisciplinaryfield. It covers both introductory and advanced material andprovides students and researchers in remote sensing as well asimaging, optics, and electromagnetic theory with a one-stopreference to a wealth of current research results. Plus, Scatteringof Electromagnetic Waves contains detailed discussions of bothanalytical and numerical methods, including cutting-edge techniquesfor the recovery of earth/land parametric information. The three volumes are entitled respectively Theories andApplications, Numerical Simulation, and Advanced Topics. In thefirst volume, Theories and Applications, Leung Tsang (University ofWashington) Jin Au Kong (MIT), and Kung-Hau Ding (Air ForceResearch Lab) cover: * Basic theory of electromagnetic scattering * Fundamentals of random scattering * Characteristics of discrete scatterers and rough surfaces * Scattering and emission by layered media * Single scattering and applications * Radiative transfer theory and solution techniques * One-dimensional random rough surface scattering

Wave Scattering from Statistically Rough Surfaces Jan 15 2021 Wave Scattering from Statistically Rough Surfaces discusses the complications in radio physics and hydro-acoustics in relation to wave transmission under settings seen in nature. Some of the topics that are covered include radar and sonar, the effect of variations in topographic relief or ocean waves on the transmission of radio and sound waves, the reproduction of radio waves from the lower layers of the ionosphere, and the oscillations of signals within the earth-ionosphere waveguide. The book begins with some fundamental idea of wave transmission theory and the theory of random processes as used to rough surfaces and to wave fields. This discussion is followed by an analysis of the average fields of sound and electromagnetic waves. A section on spatial correlation characteristics in the approximation of small perturbations is then given. Another chapter of the text explains the Kirchhoff method. The book will provide useful information to physicists, mechanical engineer, students, and researchers in the field of acoustics.

Theory of Wave Scattering From Random Rough Surfaces, Jun 07 2020 A review of theories developed for the study of acoustic, elastic and electromagnetic wave scattering from randomly rough surfaces, and a comprehensive summary of the latest techniques. Different theories are illustrated by experimental data.With applications in radar, sonar, ultrasonics and optics this book will be invaluable to graduate students, researchers and engineers.

Plane-wave Scattering-matrix Theory of Antennas and Antenna-antenna Interactions Oct 12 2020

Scattering Theory of Waves and Particles Apr 05 2020 Much progress has been made in scattering theory since the publication of the first edition of this book fifteen years ago, and it is time to update it. Needless to say, it was impossible to incorporate all areas of new develop ment. Since among the newer books on scattering theory there are three excellent volumes that treat the subject from a much more abstract mathe matical point of view (Lax and Phillips on electromagnetic scattering, Amrein, Jauch and Sinha, and Reed and Simon on quantum scattering), I have refrained from adding material concerning the abundant new mathe matical results on time-dependent formulations of scattering theory. The only exception is Dollard's beautiful "scattering into cones" method that connects the physically intuitive and mathematically clean wave-packet description to experimentally accessible scattering rates in a much more satisfactory manner than the older procedure. Areas that have been substantially augmented are the analysis of the three-dimensional Schrodinger equation for non central potentials (in Chapter 10), the general approach to multiparticle reaction theory (in Chapter 16), the specific treatment of three-particle scattering (in Chapter 17), and inverse scattering (in Chapter 20). The additions to Chapter 16 include an introduction to the two-Hilbert space approach, as well as a derivation of general scattering-rate formulas. Chapter 17 now contains a survey of various approaches to the solution of three-particle problems, as well as a discussion of the Efimov effect.

Wave Scattering Theory Aug 10 2020 The Fourier transform technique has been widely used in electrical engineer ing, which covers signal processing, communication, system control, electro magnetics, and optics. The Fourier transform-technique is particularly useful in electromagnetics and optics since it provides a convenient mathematical representation for wave scattering, diffraction, and propagation. Thus the Fourier transform technique has been long applied to the wave scattering problems that are often encountered in microwave antenna, radiation, diffrac tion, and electromagnetic interference. In order to u~derstand wave scattering in general, it is necessary to solve the wave equation subject to the prescribed boundary conditions. The purpose of this monograph is to present rigorous so lutions to the boundary-value problems by solving the wave equation based on the Fourier transform. In this monograph the technique of separation of vari ables is used to solve the wave equation for canonical scattering geometries such as conducting waveguide structures and rectangular/circular apertures. The Fourier transform, mode-matching, and residue calculus techniques are applied to obtain simple, analytic, and rapidly-convergent series solutions. The residue calculus technique is particularly instrumental in converting the solutions into series representations that are efficient and amenable to nu merical analysis. We next summarize the steps of analysis method for the scattering problems considered in this book. 1. Divide the scattering domain into closed and open regions. 2. Represent the scattered fields in the closed and open regions in terms of the Fourier series and transform, respectively. 3.

Seismic Wave Propagation and Scattering in the Heterogenous Earth Nov 05 2022 Seismic waves – generated both by natural earthquakes and by man-made sources – have produced an enormous amount of information about the Earth's interior. In classical seismology, the Earth is modeled as a sequence of uniform horizontal layers (or sperical shells) having different elastic properties and one determines these properties from travel times and dispersion of seismic waves. The Earth, however, is not made of horizontally uniform layers, and classic seismic methods can take large-scale inhomogeneities into account. Smaller-scale irregularities, on the other hand, require other methods. Observations of continuous wave trains that follow classic direct S waves, known as coda waves, have shown that there are heterogeneities of random size scattered randomly throughout the layers of the classic seismic model. This book focuses on recent developments in the area of seismic wave propagation and scattering through the randomly heterogeneous structure of the Earth, with emphasis on the lithosphere. The presentation combines information from many sources to present a coherent introduction to the theory of scattering in acoustic and elastic materials and includes analyses of observations using the theoretical methods developed.

Interface Effects in Elastic Wave Scattering Sep 22 2021 The authors study dynamical effects of incident compressional and distortional elastic waves on a layer of planar, cylindrical, or spherical geometry, especially focusing on the stress fields surrounding the layer. These results are derived from the exact solutions for elastic wave scattering from such interfaces developped in the first part of the book. Comparisons of numerical solutions of special problems with the analytical solutions are given and it is shown how the latter help to simplify the numerical treatment. The material presented in this monograph will help in developing composite materials with improved chemical and physical properties and in non-destructive testing of such materials. Engineers, physicists, and workers in applied mathematics will welcome this well written text. It may also be used for additional reading in a course on elasto-mechanics.

Rays, Waves, and Scattering Dec 14 2020 This one-of-a-kind book presents many of the mathematical concepts, structures, and techniques used in the study of rays, waves,

and scattering. Panoramic in scope, it includes discussions of how ocean waves are refracted around islands and underwater ridges, how seismic waves are refracted in the earth's interior, how atmospheric waves are scattered by mountains and ridges, how the scattering of light waves produces the blue sky, and meteorological phenomena such as rainbows and coronas. Rays, Waves, and Scattering is a valuable resource for practitioners, graduate students, and advanced undergraduates in applied mathematics, theoretical physics, and engineering. Bridging the gap between advanced treatments of the subject written for specialists and less mathematical books aimed at beginners, this unique mathematical compendium features problems and exercises throughout that are geared to various levels of sophistication, covering everything from Ptolemy's theorem to Airy integrals (as well as more technical material), and several informative appendixes. Provides a panoramic look at wave motion in many different contexts Features problems and exercises throughout Includes numerous appendixes, some on topics not often covered An ideal reference book for practitioners Can also serve as a supplemental text in classical applied mathematics, particularly wave theory and mathematical methods in physics and engineering Accessible to anyone with a strong background in ordinary differential equations, partial differential equations, and functions of a complex variable

Scattering of Electromagnetic Waves Dec 02 2019 A timely and authoritative guide to the state of the art of wavescattering Scattering of Electromagnetic Waves offers in three volumes acomplete and up-to-date treatment of wave scattering by randomdiscrete scatterers and rough surfaces. Written by leadingscientists who have made important contributions to wave scatteringover three decades, this new work explains the principles, methods,and applications of this rapidly expanding, interdisciplinaryfield. It covers both introductory and advanced material andprovides students and researchers in remote sensing as well asimaging, optics, and electromagnetic theory with a one-stopreference to a wealth of current research results. Plus, Scatteringof Electromagnetic Waves contains detailed discussions of bothanalytical and numerical methods, including cutting-edge techniquesfor the recovery of earth/land parametric information. The three volumes are entitled respectively Theories andApplications, Numerical Simulation, and Advanced Topics. In thesecond volume, Numerical Simulations, Leung Tsang (University ofWashington) Jin Au Kong (MIT), Kung-Hau Ding (Air Force ResearchLab), and Chi On Ao (MIT) cover: * Layered media simulations * Rough surface and volume scattering simulations * Dense media models and simulations * Electromagnetic scattering by discrete scatterers and a buriedobject * Scattering by vertical cylinders above a surface * Electromagnetic waves scattering by vegetation * Computational methods and programs used for performing varioussimulations

Wave Scattering in Complex Media: From Theory to Applications Aug 02 2022 A collection of lectures on a variety of modern subjects in wave scattering, including fundamental issues in mesoscopic physics and radiative transfer, recent hot topics such as random lasers, liquid crystals, lefthanded materials and time-reversal, as well as modern applications in imaging and communication. There is a strong emphasis on the interdisciplinary aspects of wave propagation, including light and microwaves, acoustic and elastic waves, propagating in a variety of "complex" materials (liquid crystals, media with gain, natural media, magneto-optical media, photonic and phononic materials, etc.). It addresses many different items in contemporary research: mesoscopic fluctuations, localization, radiative transfer, symmetry aspects, and time-reversal. It also discusses new (potential) applications in telecommunication, soft matter and imaging.

Seismic Wave Propagation and Scattering in the Heterogeneous Earth : Second Edition Jul 21 2021 Seismic waves - generated both by natural earthquakes and by man-made sources - have produced an enormous amount of information about the Earth's interior. In classical seismology, the Earth is modeled as a sequence of uniform horizontal layers (or spherical shells) having different elastic properties and one determines these properties from travel times and dispersion of seismic waves. The Earth, however, is not made of horizontally uniform layers, and classic seismic methods can take large-scale inhomogeneities into account. Smaller-scale irregularities, on the other hand, require other methods. Observations of continuous wave trains that follow classic direct S waves, known as coda waves, have shown that there are heterogeneities of random size scattered randomly throughout the layers of the classic seismic model. This book focuses on recent developments in the area of seismic wave propagation and scattering through the randomly heterogeneous structure of the Earth, with emphasis on the lithosphere. The presentation combines information from many sources to present a coherent introduction to the theory of scattering in acoustic and elastic materials and includes analyses of observations using the theoretical methods developed. The second edition especially includes new observational facts such as the spatial variation of medium inhomogeneities and the temporal change in scattering characteristics and recent theoretical developments in the envelope synthesis in random media for the last ten years. Mathematics is thoroughly rewritten for improving the readability. Written for advanced undergraduates or beginning graduate students of geophysics or planetary sciences, this book should also be of interest to civil engineers, seismologists, acoustical engineers, and others interested in wave propagation through inhomogeneous elastic media.

Water Wave Scattering Feb 13 2021 The theory of water waves is most varied and is a fascinating topic. It includes a wide range of natural phenomena in oceans, rivers, and lakes. It is mostly concerned with elucidation of some general aspects of wave motion including the prediction of behaviour of waves in the presence of obstacles of some special configurations that are of interest to ocean engineers. Unfortunately, even the apparently simple problems appear to be difficult to tackle mathematically unless some simplified assumptions are made. Fortunately, one can assume water to be an incompressible, in viscid and homogeneous fluid. The linearised theory of water waves is based on the assumption that the amplitude of the motion is small compared to the wave length. If rotational motion is assumed, then the linearised theory of water waves is essentially concerned with solving the Laplace equation in the water region together with linearised boundary condition. There are varied classes of problems that have been/are being studied mathematically in the literature within the framework of linearised theory of water waves for last many years. Scattering by obstacles of various geometrical configurations is one such class of water wave problems. This book is devoted to advanced mathematical work related to water wave scattering. Emphasis is laid on the mathematical and computational techniques required to study these problems mathematically. The book contains nine chapters. The first chapter is introductory in nature. It includes the basic equations of linearised theory for a single layer fluid, a two-layer fluid, solution of dispersion equations, and a general idea on scattering problems and the energy identity in water with a free surface. Chapter 2 is concerned with wave scattering involving thin rigid plates of various geometrical configurations, namely, plane vertical barriers or curved barriers, inclined barriers, horizontal barrier, and also thin elastic vertical plate. For the horizontal case, the barrier is submerged below an ice-cover modelled as a thin elastic plate floating on water. Chapter 3 discusses wave scattering by a rectangular trench by using Galerkin technique. Chapter 4 involves wave scattering by a dock by using Carleman singular integral equation followed by reduction to Riemann-Hilbert problems. Chapter 5 involves several wave scattering problems involving discontinuities at the upper surface of water by using the Wiener-Hopf technique, by reduction to Carleman singular integral equations. Chapter 6 considers scattering by a long horizontal circular cylinder either half immersed or completely submerged. In chapter 7, some important energy identities are derived for scattering problems in a single-layer and also in a two-layer fluid. Chapter 8 is concerned with wave scattering in a two-layer fluid by a thin vertical plate and by a long horizontal circular cylinder submerged in either of the two layers. Chapter 9 is the final chapter which considers a number of wave scattering problems in a single-layer or a two-layer fluid with variable bottom topography by using a simplified perturbation analysis It is hoped that this book will be useful to researchers on water waves. The several wave scattering problems presented in the book are mostly based on the research work carried out by the authors and their associates.

Wave Propagation and Scattering in Random Media Mar 29 2022 Wave Propagation and Scattering in Random Media, Volume 1: Single Scattering and Transport Theory presents the fundamental formulations of wave propagation and scattering in random media in a unified and systematic manner, as well as useful approximation techniques applicable to a variety of different situations. The emphasis is on single scattering theory and transport theory. The reader is introduced to the fundamental concepts and useful results of the statistical wave propagation theory. This volume is comprised of 13 chapters, organized around three themes: waves in random scatterers, waves in random continua, and rough surface scattering. The first part deals with the scattering and propagation of waves in a tenuous distribution of scatterers, using the single scattering theory and its slight extension to explain the fundamentals of wave fluctuations in random media without undue mathematical complexities. Many practical problems of wave propagation and scattering in the atmosphere, oceans, and other random media are discussed. The second part examines transport theory, also known as the theory of radiative transfer, and includes chapters on wave propagation in random particles, isotropic scattering, and the plane-parallel problem. This monograph is intended for engineers and scientists interested in optical, acoustic, and microwave propagation and scattering in atmospheres, oceans, and biological media.

Electromagnetic Wave Scattering on Nonspherical Particles May 07 2020 This book gives a detailed overview of the theory of electromagnetic wave scattering on single, homogeneous, but nonspherical particles. Beside the systematically developed Green’s function formalism of the first edition this second and enlarged edition contains additional material regarding group theoretical considerations for nonspherical particles with boundary symmetries, an iterative T-matrix scheme for approximate solutions, and two additional but basic applications. Moreover, to demonstrate the advantages of the group theoretical approach and the iterative solution technique, the restriction to axisymmetric scatterers of the first edition was abandoned.

Electromagnetic Wave Propagation, Radiation, and Scattering Mar 17 2021 One of the most methodical treatments of electromagnetic wave propagation, radiation, and scattering—including new applications and ideas Presented in two parts, this book takes an analytical approach on the subject and emphasizes new ideas and applications used today. Part one covers fundamentals of electromagnetic wave propagation, radiation, and scattering. It provides ample end-of-chapter problems and offers a 90-page solution manual to help readers check and comprehend their work. The second part of the book explores up-to-date applications of electromagnetic waves—including radiometry, geophysical remote sensing and imaging, and biomedical and signal processing applications. Written by a world renowned authority in the field of electromagnetic research, this new edition of Electromagnetic Wave Propagation, Radiation, and Scattering: From Fundamentals to Applications presents detailed applications with useful appendices, including mathematical formulas, Airy function, Abel’s equation, Hilbert transform, and Riemann surfaces. The book also features newly revised material that focuses on the following topics: Statistical wave theories—which have been extensively applied to topics such as geophysical remote sensing, bio-electromagnetics, bio-optics, and bio-ultrasound imaging Integration of several distinct yet related disciplines, such as statistical wave theories, communications, signal processing, and time reversal imaging New phenomena of multiple scattering, such as coherent scattering and memory effects Multiphysics applications that combine theories for different physical phenomena, such as seismic coda waves, stochastic wave theory, heat diffusion, and temperature rise in biological and other media Metamaterials and solitons in optical fibers, nonlinear phenomena, and porous media Primarily a textbook for graduate courses in electrical engineering, Electromagnetic Wave Propagation, Radiation, and Scattering is also ideal for graduate students in bioengineering, geophysics, ocean engineering, and geophysical remote sensing. The book is also a useful reference for engineers and scientists working in fields such as geophysical remote sensing, bio–medical engineering in optics and ultrasound, and new materials and integration with signal processing.

Radar Propagation and Scattering in a Complex Maritime Environment Mar 05 2020 This book addresses advanced numerical techniques used to significantly reduce the

complexity and memory requirement for solving the linear system that results from the discretization of the boundary integral equations by the Method of Moments (MoM). Typically, the problem of the VHF wave scattering from an object above a rough sea surface in a ducting environment is investigated as is the HF radar propagation above the Earth in the presence of islands. Along with these topics, the book also covers rapid asymptotic theories, which are derived and compared with references methods based on the MoM. Presents tactics on scattering from both rough surfaces and near a rough surface Discusses radar propagation in ducting environments Includes numerical techniques to accelerate MoM

Electromagnetic Wave Scattering from Random Rough Surfaces Oct 24 2021 Electromagnetic wave scattering from random rough surfaces is anactive, interdisciplinary area of research with myriad practicalapplications in fields such as optics, acoustics, geoscience andremote sensing. Focusing on the case of random rough surfaces, this book presentsclassical asymptotic models used to describe electromagnetic wavescattering. The authors begin by outlining the basic conceptsrelevant to the topic before moving on to look at the derivation ofthe scattered field under asymptotic models, based on theKirchhoff-tangent plane, in order to calculate both the scatteredfield and the statistical average intensity. More elaborated asymptotic models are also described for dealingwith specific cases, and numerical results are presented toillustrate these models. Comparisons with a reference numericalmethod are made to confirm and refine the theoretical validitydomains. The final chapter derives the expressions of the scatteringintensities of random rough surfaces under the asymptotic models.Its expressions are given for their incoherent contributions, fromstatistical calculations. These results are then compared withnumerical computations using a Monte-Carlo process, as well as withexperimental models, for sea surface backscattering. Contents 1. Electromagnetic Wave Scattering from Random Rough Surfaces:Basics. 2. Derivation of the Scattered Field under Asymptotic Models. 3. Derivation of the Normalized Radar Cross-Section underAsymptotic Models. APPENDIX 1. Far-Field Scattered Fields under the Method ofStationary Phase. APPENDIX 2. Calculation of the Scattering Coefficients under the GOfor 3D Problems. About the Authors Nicolas Pinel worked as a Research Engineer at the IETR(Institut d'Electronique et de Télécommunicationsde Rennes) laboratory at Polytech Nantes (University of Nantes,France) before joining Alyotech Technologies in Rennes, France, inJuly 2013. His research interests are in the areas of radar andoptical remote sensing, scattering and propagation. In particular,he works on asymptotic methods of electromagnetic wave scatteringfrom random rough surfaces and layers. Christophe Bourlier works at the IETR (Institutd'Electronique et de Télécommunications de Rennes)laboratory at Polytech Nantes (University of Nantes, France) and isalso a Researcher at the French National Center for ScientificResearch (CNRS) on electromagnetic wave scattering from roughsurfaces and objects for remote sensing applications and radarsignatures. He is the author of more than 160 journal articles andconference papers.

Wave Scattering in Complex Media: From Theory to Applications Oct 04 2022 A collection of lectures on a variety of modern subjects in wave scattering, including fundamental issues in mesoscopic physics and radiative transfer, recent hot topics such as random lasers, liquid crystals, lefthanded materials and time-reversal, as well as modern applications in imaging and communication. There is a strong emphasis on the interdisciplinary aspects of wave propagation, including light and microwaves, acoustic and elastic waves, propagating in a variety of "complex" materials (liquid crystals, media with gain, natural media, magneto-optical media, photonic and phononic materials, etc.). It addresses many different items in contemporary research: mesoscopic fluctuations, localization, radiative transfer, symmetry aspects, and time-reversal. It also discusses new (potential) applications in telecommunication, soft matter and imaging.

Wave Scattering from Rough Surfaces Jul 09 2020 Since the fIrst edition of this book was published in the 1994, the theory of wave scattering from rough surfaces has continued to develop intensively. The community of researchers working in this area keeps growing, which provides justifIcation for issuing this second edition. In preparing the second edition, I was challenged by the problem of se lecting new material from the many important results obtained recently. Even tually, a new section was added to the central Chap. 6 of this book. This sec tion describes the operator expansion technique put forward by M. Milder, which conforms well with the general approach adopted in the book and which to my mind is one of the most promising. Remote sensing of the terrain and ocean surface represents one of the most important and interesting challenges to the theory of wave scattering from rough surfaces. Rapid progress in electronics results in sensors with new capabilities. New powerful computers and data communication systems allow more sophisticated data processing techniques. What information about soil or air-sea interaction processes can be obtained from gigaflops of data streaming from air-or space-borne radars? To use this information efficiently, one cannot rely entirely on heuristic approaches and needs adequate theory. I hope that this book will contribute to progress in this important area.

Wave Scattering by Small Bodies of Arbitrary Shapes Apr 17 2021 This book presents analytical formulas which allow one to calculate the S-matrix for the acoustic and electromagnetic wave scattering by small bodies or arbitrary shapes with arbitrary accuracy. Equations for the self-consistent field in media consisting of many small bodies are derived. Applications of these results to ultrasound mammography and electrical engineering are considered.The above formulas are not available in the works of other authors. Their derivation is based on a mathematical theory for solving integral equations of electrostatics, magnetostatics, and other static fields. These equations are at a simple characteristic value. Convergent iterative processes are constructed for stable solution of these equations. The theory completes the classical work of Rayleigh on scattering by small bodies by providing analytical formulas for polarizability tensors for bodies of arbitrary shapes.

Forward Brillouin Scattering in Standard Optical Fibers Nov 12 2020 This book, the first dedicated to the topic, provides a comprehensive treatment of forward stimulated Brillouin scattering (SBS) in standard optical fibers. SBS interactions between guided light and sound waves have drawn much attention for over fifty years, and optical fibers provide an excellent playground for the study of Brillouin scattering as they support guided modes of both wave types and provide long interaction lengths. This book is dedicated to forward SBS processes that are driven by co-propagating optical fields. The physics of forward SBS is explained in detail, starting from the fundamentals of interactions between guided optical and acoustic waves, with emphasis given to the acoustic modes that are stimulated in the processes. The realization of forward SBS in standard single-mode, polarization-maintaining and multi-core fibers is then discussed in depth. Innovative potential applications in sensors, monitoring of coating layers, lasers, and radio-frequency oscillators are presented. This book introduces the subject to graduate students in optics and applied physics, and it will be of interest to scientists working in fiber-optics, nonlinear optics and opto-mechanics. Provides the first treatment of forward stimulated Brillouin scattering (SBS) in book form; Reflects the dramatic recent increase in interest in forward SBS processes , driven in part by the promise of new fiber sensing concepts; Delivers a solid and comprehensive grounding in the physics of forward SBS along with detailed experimental set-ups, measurement protocols, and applications.

Lectures in Scattering Theory Oct 31 2019 Lectures in Scattering Theory discusses problems in quantum mechanics and the principles of the non-relativistic theory of potential scattering. This book describes in detail the properties of the scattering matrix and its connection with physically observable quantities. This text presents a stationary formulation of the scattering problem and the wave functions of a particle found in an external field. This book also examines the analytic properties of the scattering matrix, dispersion relations, complex angular moments, as well as the separable representation of the scattering amplitude. The text also explains the method of factorizing the potential and the two-particle scattering amplitude, based on the Hilbert-Schmidt theorem for symmetric integral equations. In investigating the problem of scattering in a three-particle system, this book notes that the inapplicability of the Lippman-Schwinger equations can be fixed by appropriately re-arranging the equations. Faddeev equations are the new equations formed after such re-arrangements. This book also cites, as an example, the scattering of a spin-1/2 particle by a spinless particle (such as the scattering of a nucleon by a spinless nucleus). This text is suitable for students and professors dealing with quantum mechanics, theoretical nuclear physics, or other fields of advanced physics.

Electromagnetic Wave Propagation, Radiation, and Scattering May 19 2021 One of the most methodical treatments of electromagnetic wave propagation, radiation, and scattering—including new applications and ideas Presented in two parts, this book takes an analytical approach on the subject and emphasizes new ideas and applications used today. Part one covers fundamentals of electromagnetic wave propagation, radiation, and scattering. It provides ample end-of-chapter problems and offers a 90-page solution manual to help readers check and comprehend their work. The second part of the book explores up-to-date applications of electromagnetic waves—including radiometry, geophysical remote sensing and imaging, and biomedical and signal processing applications. Written by a world renowned authority in the field of electromagnetic research, this new edition of Electromagnetic Wave Propagation, Radiation, and Scattering: From Fundamentals to Applications presents detailed applications with useful appendices, including mathematical formulas, Airy function, Abel's equation, Hilbert transform, and Riemann surfaces. The book also features newly revised material that focuses on the following topics: Statistical wave theories—which have been extensively applied to topics such as geophysical remote sensing, bio-electromagnetics, bio-optics, and bio-ultrasound imaging Integration of several distinct yet related disciplines, such as statistical wave theories, communications, signal processing, and time reversal imaging New phenomena of multiple scattering, such as coherent scattering and memory effects Multiphysics applications that combine theories for different physical phenomena, such as seismic coda waves, stochastic wave theory, heat diffusion, and temperature rise in biological and other media Metamaterials and solitons in optical fibers, nonlinear phenomena, and porous media Primarily a textbook for graduate courses in electrical engineering, Electromagnetic Wave Propagation, Radiation, and Scattering is also ideal for graduate students in bioengineering, geophysics, ocean engineering, and geophysical remote sensing. The book is also a useful reference for engineers and scientists working in fields such as geophysical remote sensing, bio–medical engineering in optics and ultrasound, and new materials and integration with signal processing.

Scattering, Two-Volume Set Aug 22 2021 Part 1: SCATTERING OF WAVES BY MACROSCOPIC TARGET -- Interdisciplinary aspects of wave scattering -- Acoustic scattering -- Acoustic scattering: approximate methods -- Electromagnetic wave scattering: theory -- Electromagnetic wave scattering: approximate and numerical methods -- Electromagnetic wave scattering: applications -- Elastodynamic wave scattering: theory -- Elastodynamic wave scattering: Applications -- Scattering in Oceans -- Part 2: SCATTERING IN MICROSCOPIC PHYSICS AND CHEMICAL PHYSICS -- Introduction to direct potential scattering -- Introduction to Inverse Potential Scattering -- Visible and Near-visible Light Scattering -- Practical Aspects of Visible and Near-visible Light Scattering -- Nonlinear Light Scattering -- Atomic and Molecular Scattering: Introduction to Scattering in Chemical -- X-ray Scattering -- Neutron Scattering -- Electron Diffraction and Scattering -- Part 3: SCATTERING IN NUCLEAR PHYSICS -- Nuclear Physics -- Part 4: PARTICLE SCATTERING -- State of the Art of Peturbative Methods -- Scattering Through Electro-weak Interactions (the Fermi Scale) -- Scattering Through Strong Interactions (the Hadronic or QCD Scale) -- Part 5: SCATTERING AT EXTREME PHYSICAL SCALES -- Scattering at Extreme Physical Scales -- Part 6: SCATTERING IN MATHEMATICS AND NON-PHYSICAL SCIENCES -- Relations with Other Mathematical Theories -- Inverse Scattering Transform and Non-linear Partial Differenttial Equations -- Scattering of Mathematical Objects.

Method of Moments for 2D Scattering Problems Jun 27 2019 Electromagnetic wave scattering from randomly rough surfaces inthe presence of scatterers is an active,

interdisciplinary area ofresearch with myriad practical applications in fields such asoptics, acoustics, geoscience and remote sensing. In this book, the Method of Moments (MoM) is applied to compute thefield scattered by scatterers such as canonical objects (cylinderor plate) or a randomly rough surface, and also by an object aboveor below a random rough surface. Since the problem is considered tobe 2D, the integral equations (IEs) are scalar and only the TE(transverse electric) and TM (transverse magnetic) polarizationsare addressed (no cross-polarizations occur). In Chapter 1, the MoMis applied to convert the IEs into a linear system, while Chapter 2compares the MoM with the exact solution of the field scattered bya cylinder in free space, and with the Physical Optics (PO)approximation for the scattering from a plate in free space.Chapter 3 presents numerical results, obtained from the MoM, of thecoherent and incoherent intensities scattered by a random roughsurface and an object below a random rough surface. The finalchapter presents the same results as in Chapter 3, but for anobject above a random rough surface. In these last two chapters,the coupling between the two scatterers is also studied in detailby inverting the impedance matrix by blocks. Contents 1. Integral Equations for a Single Scatterer: Method of Momentsand Rough Surfaces. 2. Validation of the Method of Moments for a SingleScatterer. 3. Scattering from Two Illuminated Scatterers. 4. Scattering from Two Scatterers Where Only One isIlluminated. Appendix. Matlab Codes. About the Authors Christophe Bourlier works at the IETR (Institutd'Electronique et de Télécommunications de Rennes)laboratory at Polytech Nantes (University of Nantes, France) aswell as being a Researcher at the French National Center forScientific Research (CNRS) on electromagnetic wave scattering fromrough surfaces and objects for remote sensing applications andradar signatures. He is the author of more than 160 journalarticles and conference papers. Nicolas Pinel is currently working as a Research Engineer at theIETR laboratory at Polytech Nantes and is about to join AlyotechTechnologies in Rennes, France. His research interests are in theareas of radar and optical remote sensing, scattering andpropagation. In particular, he works on asymptotic methods ofelectromagnetic wave scattering from random rough surfaces andlayers. Gildas Kubické is in charge of the "Expertise inelectroMagnetism and Computation" (EMC) laboratory at the DGA(Direction Générale de l'Armement), French Ministryof Defense, where he works in the field of radar signatures andelectromagnetic stealth. His research interests includeelectromagnetic scattering and radar cross-section modeling.

Rays, Waves, and Scattering Apr 29 2022 This one-of-a-kind book presents many of the mathematical concepts, structures, and techniques used in the study of rays, waves, and scattering. Panoramic in scope, it includes discussions of how ocean waves are refracted around islands and underwater ridges, how seismic waves are refracted in the earth's interior, how atmospheric waves are scattered by mountains and ridges, how the scattering of light waves produces the blue sky, and meteorological phenomena such as rainbows and coronas. Rays, Waves, and Scattering is a valuable resource for practitioners, graduate students, and advanced undergraduates in applied mathematics, theoretical physics, and engineering. Bridging the gap between advanced treatments of the subject written for specialists and less mathematical books aimed at beginners, this unique mathematical compendium features problems and exercises throughout that are geared to various levels of sophistication, covering everything from Ptolemy's theorem to Airy integrals (as well as more technical material), and several informative appendixes. Provides a panoramic look at wave motion in many different contexts Features problems and exercises throughout Includes numerous appendixes, some on topics not often covered An ideal reference book for practitioners Can also serve as a supplemental text in classical applied mathematics, particularly wave theory and mathematical methods in physics and engineering Accessible to anyone with a strong background in ordinary differential equations, partial differential equations, and functions of a complex variable

Wave Scattering from Rough Surfaces Jan 27 2022 Diverse areas of physics and its applications deal with wave scattering at rough surfaces: optics, acoustics, remote sensing, radio astronomy, physics of solids, diffraction theory, radio and wave-propagation techniques, etc. The mathe matical description of relevant problems is rather universal and theoretical methods analysing this phenomenon form a definite area of mathematical physics. It was founded by Lord Rayleigh at the beginning of the 20th century and has been intensively developed since 1950 in response to practical needs. Modern theory involves, along with the classical methods, some new ap proaches with much more extensive possibilities. The theoretical methods describing wave scattering at rough surfaces repre sent the subject of this book. Having studied this area over many years, the author came to the conclusion that most of the results found in this theory can easily be obtained and comprehended in the framework of a rather universal scheme and this became the motive for writing the present monograph. The first half of the book deals with the classical results. However, several new problems are considered in connection with the methods used here (for example, some applications of the Rayleigh hypothesis and its relation to the Lippman argument). The second half is fully devoted to recent results presented in papers but not yet in books. For this reason the author hopes that the present book will be of interest to both newcomers and experts in this area.

Radio Wave Scattering in the Interstellar Medium Sep 30 2019

Electromagnetic Wave Scattering on Nonspherical Particles Jan 03 2020 Scatteringofelectromagneticwavesonthree-dimensional,dielectricstructures is a basic interaction process in physics, which is also of great practical - portance. Most of our visual impressions are caused not by direct but by scattered light, as everybody can experience of looking directly at the sun. Several modern measurement technologies in technical and medical diagn- tics are also based on this interaction process. Atmospheric remote sensing with lidar and radar as well as nephelometer instruments for measuring s- pended particulates in a liquid or gas colloid are only a few examples where scattered electromagnetic waves provide us with information concerning the structure and consistence of the objects under consideration. Using the inf- mation of the elastically scattered electromagnetic wave is a common ground of most of those measuring methods. The phrase "elastically scattered" - presses the restriction that we consider such interaction processes only where the scattered wave possesses the same wavelength as the primary incident wave. This book addresses this special scattering problem.